2 Technical Support

Financial Analysis

Straight to Your Bottom Line

The savings from your energy bills go straight to improving your profits. The National Restaurant Association reports that the average restaurant typically spends approximately two percent of its revenue on energy. Approximately four percent of revenue becomes profit. So if a business owner reduces energy costs by 25 percent (from 2 percent to 1.5 percent), total bottom-line profit increases from 4 percent to 4.5 percent of revenue. This increase in profit is the same as a 12.5 percent increase in sales!

Use the worksheet on this page to calculate the sales increases required to match the value of your savings opportunities.

Indirect Financial Benefits

In addition, the total return on your project includes these financial components that are quite real, if indirect:

Enhanced employee productivity. Due to enhanced comfort and improved lighting conditions, the productivity of your staff may increase.

Operations and maintenance savings. Many energy-efficiency technologies significantly reduce your operations and maintenance requirements, saving money and staff time.

Increased customer comfort. Building upgrades will improve your facility's appearance, make your products look their best, and help your customers enjoy their visit. This can increase sales.

Increased asset value. Efficient businesses have higher market values than wasteful ones. Studies on home sales show an $11 increase in sales price for every $1 decrease in annual energy costs. Studies on businesses show a 3-percent increase in stock value after energy upgrades are announced. The market recognizes the business benefits of energy-efficient operation.

Protection from energy inflation. By performing energy-saving upgrades, you are replacing the monthly expense of your energy bills with the fixed cost of the capital improvements. Lower

Savings from your energy bills may directly improve your profits.

What Is Energy Worth to You?

1. You've got a great energy savings idea. How much will it save per year? (A) $____
2. Enter your pretax profit as a percentage of sales: (B) _____ percent
3. Divide A by B: (C) _____

Line (C) shows your equivalent annual increase in sales once your savings have paid for the cost of the measure. The table below will help you quickly look up the equivalent sales amount.

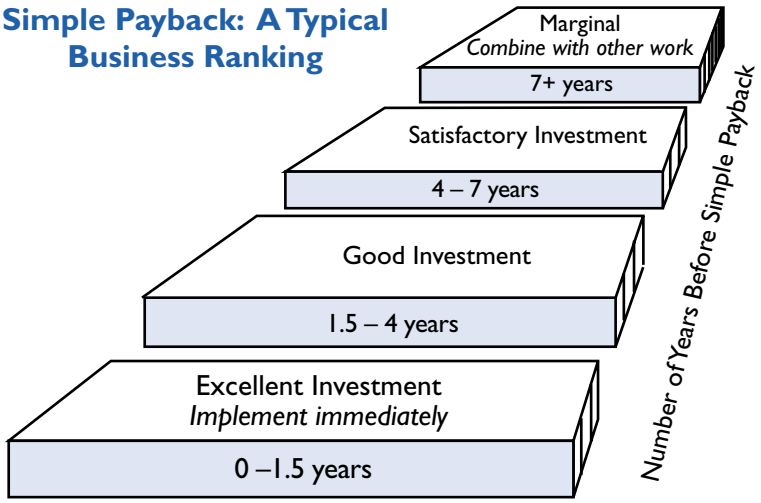
Equivalent Annual Increase in Sales

Annual Cost Savings for the Measure	Profit as a Percentage of Sales			
	2%	5%	10%	20%
$10	$500	$200	$100	$50
$100	$5,000	$2,000	$1,000	$500
$1,000	$50,000	$20,000	$10,000	$5,000
$10,000	$500,000	$200,000	$100,000	$50,000
$100,000	$5,000,000	$2,000,000	$1,000,000	$500,000

Spreading the Word

The Uptown Shelby Association in Shelby, North Carolina (pop. 14,669) is reaping all of the benefits from their involvement with Rebuild America and the ENERGY STAR small business program. Its Rebuild America partnership, Rebuild Shelby, promotes the small business program to its downtown, small commerical, business owners. Ted Alexander, the executive director of the Uptown Shelby Association states, "As a partner in Rebuild America, we wanted to promote the ENERGY STAR small business service as an important opportunity that local businesses should take advantage of." Alexander took the initiative in marketing by requesting hundreds of small business brochures, and along with a letter describing the services offered, sent them to local business and property owners to educate them in the positives of energy efficiency.

Simple Payback: A Typical Business Ranking



energy use will always result in lower cost—more so if energy prices rise.

Marketing benefits. Your participation in the ENERGY STAR for small business program communicates your commitment to environmental stewardship. This message differentiates your business from those of your competitors.

Your exact mix of indirect benefits will vary by business type and upgrades performed. For many projects, these indirect benefits will be worth several times the money you save in energy alone.

But Is It Really Worth the Time and Money?

Once you are convinced that energy-efficiency investments make financial sense in general, you still have to evaluate individual upgrades to decide which to pursue. The two most common evaluation tools are simple payback and internal rate of return (IRR).

Simple payback. Simple payback is the number of years it takes to recover the cost of the energy upgrade from the energy savings. A simple payback under four years indicates a worthwhile project. Measures with simple payback times of less than 1.5 years are excellent opportunities and should be implemented immediately.

Example of a Simple Payback Calculation. Your utility gives you a free energy assessment and tells you that if you replace 20 100-watt incandescent bulbs used 24 hours a day in your stairways with 30-watt compact fluorescent bulbs (30 watts each) you'll save $980 per year. The upgrade will cost you $400.

Your simple payback is $400 ÷ $980 = 0.4 years, or just under 5 months.

Many businesses use simple payback to make financial decisions. The only significant shortcoming of the simple payback concept is that it doesn't take into account the expected life of the upgrade. For example, if the compact fluorescent lamps described above lasted only as long as incandescent lamps, they would burn out in less than three months. Fortunately, compact fluorescent lamps last 9 to 13 times longer, so you might want your analysis to take that into account.

Internal Rate of Return. Expressing an upgrade in terms of IRR will help you compare the financial results of

Compare Your Energy-Efficiency Investments to the Interest Rates You Can Get at a Bank

This table will tell you the Internal Rate of Return if you have already calculated the simple payback.

Simple Payback	8 years							0%	4%
	6 years						0%	7%	11%
	5 years					0%	5%	12%	15%
	4 years				0%	8%	13%	19%	21%
	3 years			0%	13%	20%	24%	29%	31%
	2.5 years			10%	22%	29%	33%	37%	38%
	2 years		0%	23%	35%	41%	45%	48%	49%
	1.5 years		22%	45%	55%	60%	63%	65%	66%
	1 year	0%	62%	84%	93%	97%	98%	100%	100%
	0.5 years	100%	173%	192%	197%	199%	200%	200%	200%
	0 years	1 year	2 years	3 years	4 years	5 years	6 years	8 years	10 years
		Lifetime of new equipment or length of your planning horizon, whichever is shorter							

an upgrade against other investments. (See the glossary for the definition of IRR.) To calculate IRR you'll want to use a computer spreadsheet program or a financial calculator; you can use the table on this page as a general reference.

You can compare the IRR you calculate with the interest rates available at banks or through other investments. A good rule of thumb is that projects with IRRs above 20 percent are excellent investments and should be implemented.

Example of IRR. Converting your warehouse heating system from natural gas unit heaters to gas-fired radiant heaters will cost $6,000 and save $1,500 a year, which is a simple payback of four years. You can calculate the IRR for this investment as 21 percent (using a 10-year planning horizon), which makes it a very good financial option. Compare this with

Simple payback is the number of years it takes to recover the cost of the energy upgrade from the energy savings.

Success Stories

The manager of a small restaurant in St. Louis installed new lights and roof insulation. The total project cost $600 and saved approximately the same amount in a year. The business' overall profit margin was five percent profit against revenue.

Because energy cost savings went straight to the bottom line, the measures contributed $600 to the business' pretax profit after the first year ended.

The savings were worth the equivalent of $12,000 in additional sales. For the manager, cost reductions of $600 were easier to achieve than increasing sales by $12,000.

Upgrades should generally be implemented if the IRR is above 20 percent.

bank interest rates or other investments you might make (even including other ways to improve your business such as marketing or staff training) to decide whether to do this upgrade.

Where Can I Learn More?

Call the toll-free ENERGY STAR hotline at 1-888-STAR YES and ask for the brochures listed below:

Introducing Your Company's Newest Profit Center, EPA 430-R-97-004. This is an introduction to the concept that energy upgrades are financial investments just like other business uses of capital.

Business Analysis for Energy-Efficiency Investments, EPA 430-B-97-002. This brochure describes in more detail the business-analysis approach you can use to decide if a particular upgrade or set of upgrades makes sense to invest.

Financing Your Energy-Efficiency Upgrade, EPA 430-B-97-003. This brochure describes the many financial and accounting aspects of upgrade projects in great detail. Use this information to finance your projects with the best impact on your balance sheet, cash flow, taxes, and ultimate return.

Visit special Web pages for restaurants, grocery stores, lodging, manufacturers, home-based, and other business types at www.epa.gov/smallbiz, or ask for "small business tech support" at 1-888-STAR YES.

Success Stories

Kiddie U, a 15,400 sq. ft. daycare and learning facility in Orlando, Florida, has the lowest energy costs per sq.ft. of any comparable facility in the state, according to the Energy Conservation Assistance Program at the University of Central Florida Small Business Development Center, which provided technical support for Kiddie U's upgrade. At $1,500 per month for combined water and energy costs, President Joseph Manella's new facility costs about 40 percent less to operate than his prior building, due to high efficiency air-conditioning, programmable thermostats, T8 fluorescent lamps with electronic ballasts, CFLs, occupancy sensors, and improved insulation.

Prioritizing Your Projects

Use the ENERGY STAR five-stage concept to help organize a strategy for putting potential upgrades on a timeline. Each stage of the program builds upon the accomplishments of the previous stages to maximize potential energy savings, minimize investment requirements, and improve comfort and profitability for your business.

Rebuild America promotes a whole-building, systems approach in order to significantly increase energy savings for each building and to accommodate the wide variety of project types and partnerships in the program. A comprehensive analysis of the whole building is recommended to take full advantage of equipment savings due to reduced heating and cooling loads and to develop a total project plan. There also is a big savings in time and effort, and possibly reduced bids, by contracting for the total job. A phased approach to project implementation may be necessary for some projects, but building owners often go with the whole package so they can finish construction and enjoy full benefits.

Stage One: Lighting

Many retailers and offices spend half of their electric bills on lighting, so it makes sense to address lighting first. Efficient lighting pays for itself quickly. Lighting upgrades such as installation of compact fluorescent lamps and light-emitting diode (LED) exit signs are relatively simple to implement and can reliably deliver the expected cost savings. Upgrade your lighting before changing your heating or cooling systems because increasing your lighting efficiency lowers your air-conditioning requirements. In the winter, heating your building with your lights is expensive because new lights operate much cooler than old lights. Use your heating system instead. Five years of ENERGY STAR experience show that successful lighting upgrades provide Partners with dramatic savings and positive reinforcement for pursuing further projects. Lighting upgrades often improve lighting quality, which can boost worker productivity and enhance the appearance of your merchandise.

Stage Two: Building Tune-Up

Bring your building to its peak design performance by addressing operations, maintenance, and small repairs. You can do many tune-up activities yourself, such as cleaning equipment and replacing filters. Other measures, such as adjusting your furnace or repairing malfunctioning controls, will require the services of contractors. Stage Two upgrades improve occupant comfort and indoor air quality, and the upgrades are no-cost or low-cost strategies that lay the foundation for further savings later.

Stage Three: Load Reduction

Load reduction strategies reduce the amount of heating, cooling, or electricity use through low-cost measures that are easy to implement. Reducing the amount of heated or cooled air that escapes from your building through cracks in windows or ducts will reduce your heating and cooling costs.

Each upgrade stage builds upon the previous stages to maximize -potential energy savings, minimize investment requirements, and improve comfort and profitability.

Window films, shades, and awnings will reduce heat gain in the summer. Or you can take advantage of landscaping measures such as adding trees and vines to block direct sunlight.

You can take simple steps to ensure that lights and office equipment are not left on by accident. And select ENERGY STAR-labeled new equipment to guarantee the best future savings.

Stage Four: Heating and Cooling Distribution System

In this stage, you should evaluate the efficiency of the fans and pumps associated with the heating, ventilating, and air-conditioning (HVAC) systems in your building. Upgrades to your distribution system will save energy while improving occupant comfort.

Stage Five: Heating and Cooling Plant

By implementing Stages One through Four, you will reduce the overall heating and cooling requirements in your facility and will be able to afford smaller and more efficient heating and cooling units. Because replacing heating or cooling equipment requires the largest commitment of capital, we recommend that you implement these replacements last. Stage Five is when all your previous hard work and commitment will pay off.

The five-stage concept is illustrated in the chart on this page.

Where Can I Learn More?

If you would like more information on the technical aspects of the ENERGY STAR five-stage approach to building improvements, call 1-888-STAR YES and ask for the free, more advanced *ENERGY STAR Buildings Manual.*

Stage One: Lighting

- Fast payback
- Improves comfort
- Reduces cooling costs

Stage Two: Building Tune-Up

- Low-cost measures
- Operations and maintenance
- Reduces heating and cooling costs

Stage Three: Load Reduction

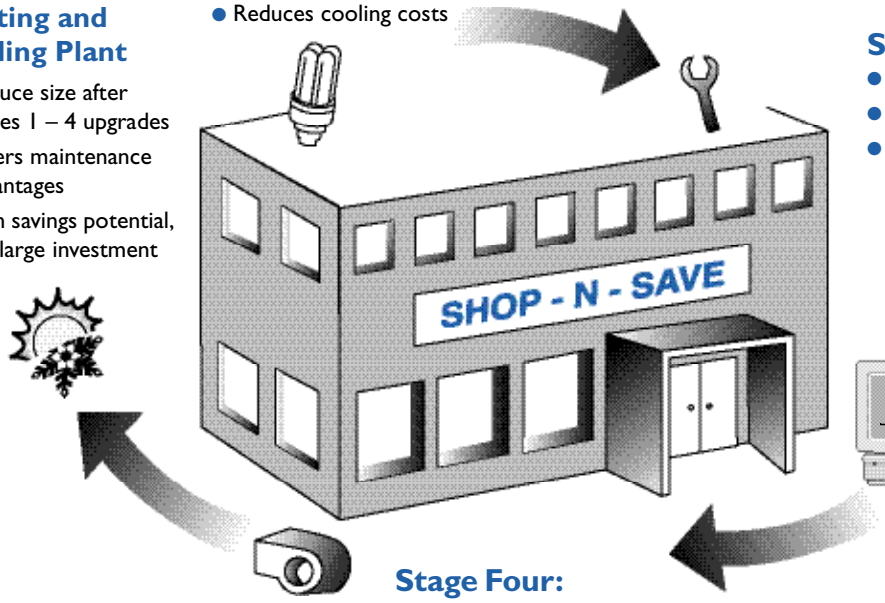
- ENERGY STAR-labeled office equipment
- Windows, window films, awnings
- Cracks sealed
- Water heater insulation

Stage Four: Heating and Cooling Distribution System

- Resize the system to meet new loads
- Install advanced controls

Stage Five: Heating and Cooling Plant

- Reduce size after Stages 1 – 4 upgrades
- Offers maintenance advantages
- High savings potential, but large investment



Lighting Part I: Concepts

Approximately 75 percent of all small business energy upgrades are related to lighting. Because lighting upgrades are so popular, we have included this special section on lighting concepts. If you have time to read it, you can be an informed shopper when it comes time to listen to contractor upgrade proposals or even to find your own lighting improvement opportunities. If you don't have the time, aren't interested in the background science, or just want to focus on action, go straight to the next section, *Lighting Part II: Upgrades.* We introduce specific suggestions on how to improve your lighting by upgrading your fixtures.

Whether displaying your merchandise, illuminating your factory, or providing security for your parking lot, lighting is one utility that you as a small business owner cannot do without. The amount and quality of the light can significantly affect the performance of your employees. At the same time, light also forms a significant part of your electric bill.

Fortunately, modern technology makes it possible for many businesses to improve lighting quality while reducing costs. This section first reviews how to determine the "right" amount of light for your business, discusses lighting quality issues such as color and glare, and then introduces the different types of lighting technologies in use.

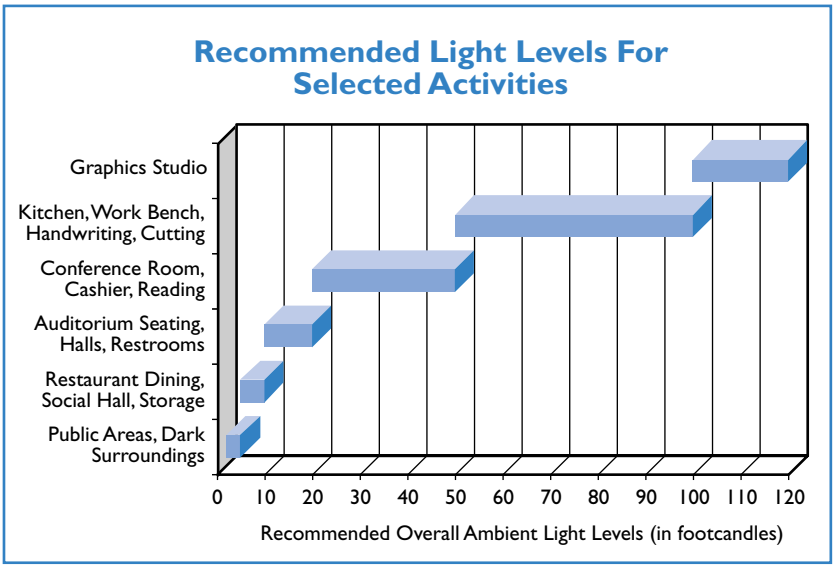
Light Levels

When everyone worked with pencils, paper, and typewriters, architects made sure that working environments had an abundance of light everywhere. Now that so many office environments require the use of computers, ideal light levels and configurations are different and often lower than in the past. This means you may have the opportunity to reduce your lighting costs and improve your working environment at the same time. Since removing lamps often requires nothing more than getting on a ladder and pulling out the lamps, the cost can be negligible and you can start saving money immediately.

Although employee preferences play a large role in optimizing light levels, the Illuminating Engineering Society provides recommended light levels for different activities as shown in the graph on this page.

Compare your light levels to recommended levels. In order to compare your lighting to recommended levels, you need to know your own existing light levels. Call your lighting contractor and ask them to take the measurements for you.

Proper light levels and light quality can measurably increase sales and productivity.



Alternatively, you may want to consider buying your own light meter. They cost about $125 and are available from lighting supply catalogs. If you buy a meter, be sure to have a lighting expert train you before you use it. Windows, reflections, and shadows will distort your readings if you're not careful.

Just try it. You don't have to bother with all those technical criteria. Remove a couple of lamps for a couple of days, and if you like the new arrangement, stick with it.

Task lighting focuses extra light just where you need it and can reduce glare and eye strain.

Consider task lighting. Just because you want bright light at the cash register doesn't mean you need the whole room lit up to that level. See if you can reduce light levels in some areas and focus light only where you need it. This is called "task-ambient lighting." This type of lighting design provides a blanket of lower level "ambient" light for orientation around large objects together with small fixtures shining on the "task." The current IES recommendations for computer use, for example, are 25 footcandles ambient, with a task or desk light providing 75 footcandles at the work surface.

Experiment with daylighting. Turn off lights near windows during daytime hours; you can do this manually, with a time clock or with special "daylighting" sensors made just for this purpose.

Light Quality

Deep-cell parabolic fixtures are great for offices with computers because they reduce reflections in the monitors.

Isn't it frustrating to stare at your computer screen and constantly find yourself looking at the reflection of a ceiling fixture? Have you seen a fellow employee tape cardboard around the monitor? Does the light in the restroom make your face look pasty and less attractive than you know you looked at home this morning? It's not that work is bad for your looks. All light is not the same. It turns out that these and other problems are lighting flaws that can often be overcome when you install more efficient lighting. Let's consider solutions to the problems one by one.

Solution 1: Task-ambient lighting. Your problem may be fixture location. Moving the monitor is one solution, certainly, but a solution that more and more interior designers recommend is a combination of background ambient and task lighting. Designers generally agree that spot lighting gives a pleasant ambiance, but it can cost more to install because it requires more fixtures. Because the overall amount of light produced is lower with a mix of background and spot lighting, the arrangement uses less electricity. The extra fixture investment can pay for itself quickly in savings on your electric bills. Happier employees can be worth even more.

Solution 2: Upgrade fixtures. Many older fluorescent fixtures use a prismatic plastic lens (see the glossary in Section 3) to scatter light around the room. This was great before the computer age because it helped ensure that all areas were evenly lit, but lenses can create bright spots in your field of view. Now that computers are used everywhere, the preferred solution is often to use fixtures with parabolic louvers that direct light where you need it while lowering glare. If you're considering an upgrade in a room with computers, definitely ask your designer or contractor about switching to fixtures with louvers.

Solution 3: Improve color. All lamps distort color compared to true sunlight, but some lamps are better than others at simulating sunlight. This property of lighting is called color rendition. Lamps that render close to true color have a color-rendering index between

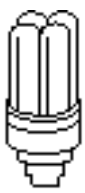
85 and 100. A CRI of 50 is very poor. If you upgrade to T-8 lamps from just about any type of T-12 lamps, your color will improve and your product will look better. And better looking merchandise is better selling merchandise.

Different Kinds of Lights

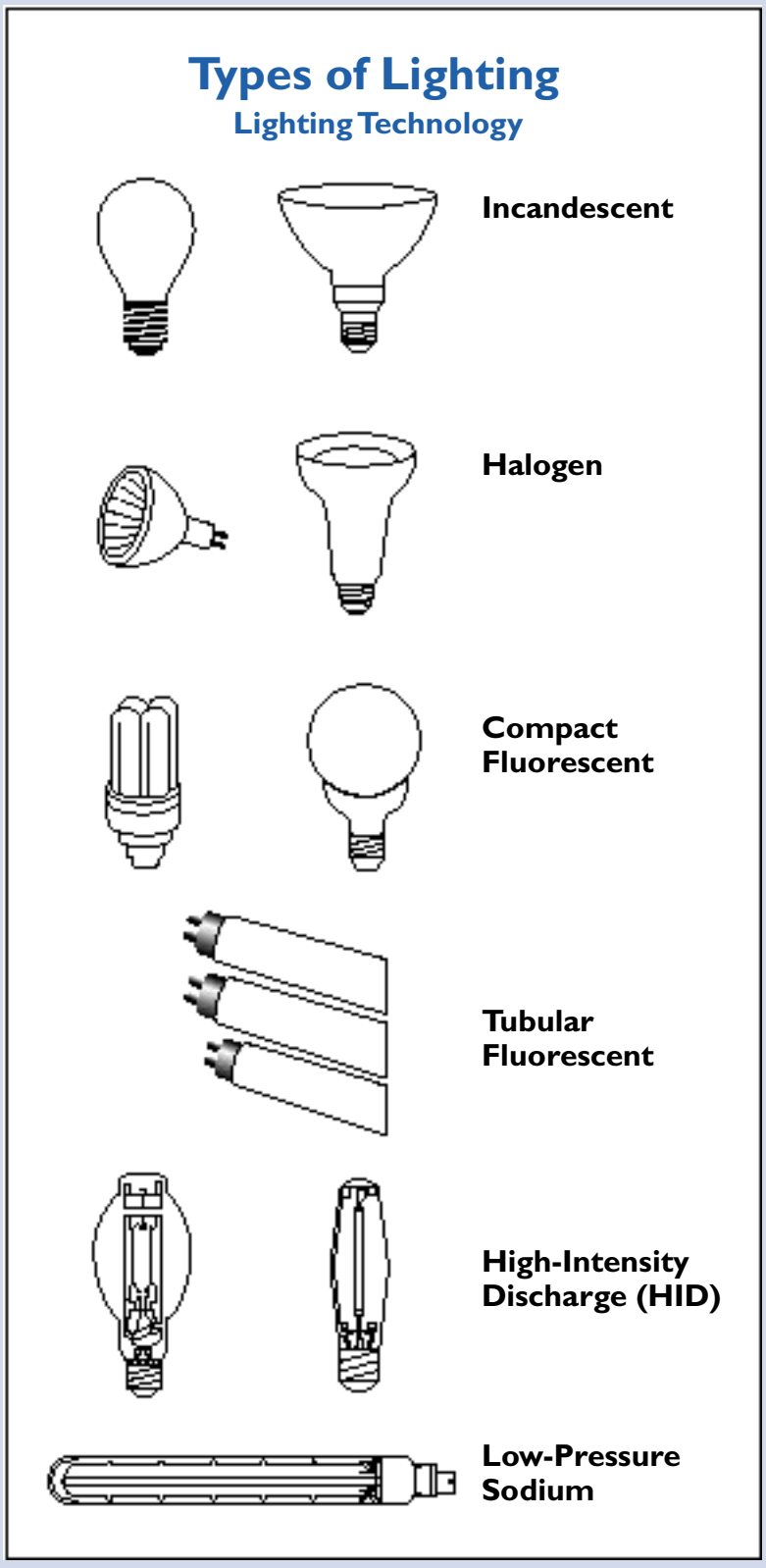
Different types of lighting are available for different applications, with a broad range of lighting efficiencies and varying degrees to which they distort color. The efficiency of lighting (more technically called efficacy) is measured by the light output per unit of energy use. Common incandescent lamps have poor efficiencies, while fluorescent lamps have much higher efficiencies. See box on this page for illustrations of the major lamp types.

Incandescent. Modern incandescent lamps derive from Thomas Edison's work before the turn of the 20th century. They are inefficient and usually have short lives but produce a pleasant color rendering similar to that of natural sunlight.

Halogen. In the past five years, halogens have surged in popularity. Halogen lamps are about twice as efficient as regular incandescent lamps and have longer lives. Halogen spotlights focus light and add a lot of pleasing "sparkle." However, they are relatively expensive to buy, and they cost more to operate than all types of lamps except incandescents.

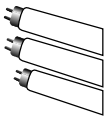


Compact fluorescent. Compact fluorescent lamps are miniature versions of standard fluorescent lamps and are usually coated to make their color more similar to that of incandescent lamps. Compact

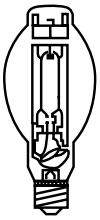


Less than five percent of the electricity consumed by an incandescent lamp is actually turned into useful light.

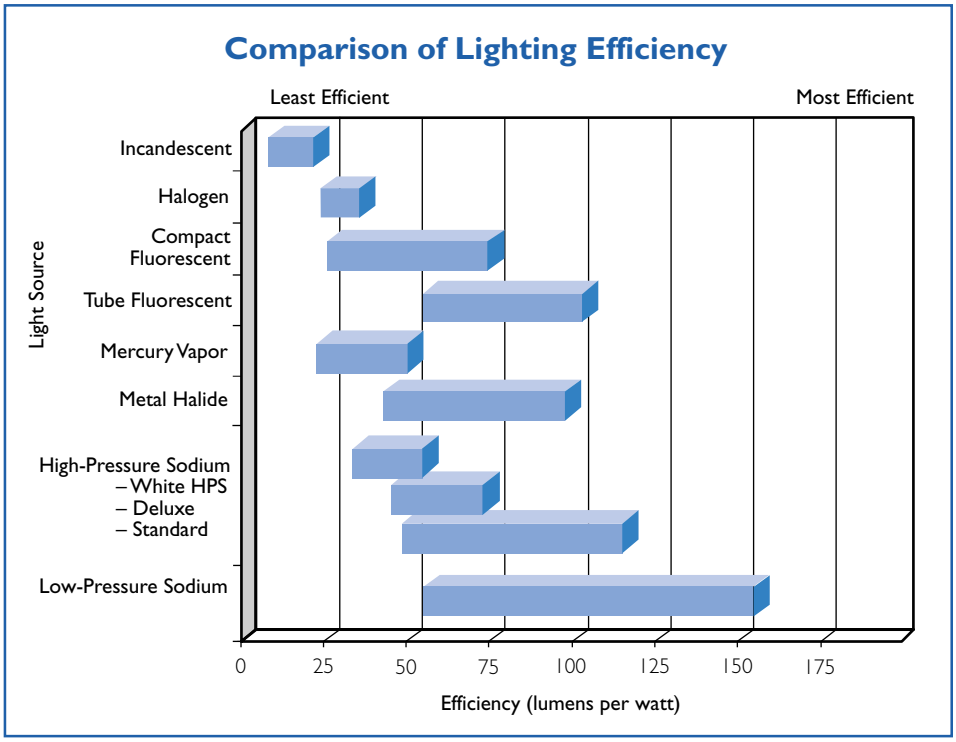
fluorescents are 4 times as efficient as incandescents and last 10 times as long in many cases, so they too are growing in popularity in the business world. They are relatively expensive to buy.



Tubular fluorescent. The ubiquitous fluorescent lamps have a wide range of efficiency and in general are about four times as efficient as incandescent lamps. They are cheap to buy, last as long as 20,000 hours, and are the staple for office lighting throughout the country.



High-intensity discharge (HID). This category of lamp includes mercury vapor, metal halide, and high-pressure sodium. HID lamps have traditionally been used mostly in warehouses and street lighting, but new research and development have created a market for lower power lamps for commercial environments. HID lamps offer good color, long life, inexpensive high ceiling and security lighting, and new retail options.



Success Stories

Business Saves With the Right Light Levels

A growing software development firm in Portland, OR, signed a 10-year lease to occupy a 30-year-old, 50,000-sq.ft. office building. The business planned to renovate much of the space before moving in. Renovation plans for each 10-ft. by 12-ft. office in the building included replacing a pair of old, 4-lamp, 4-ft. fluorescent fixtures in each office with a pair of new 4-lamp fixtures that had high-efficiency lamps and electronic ballasts.

Fortunately, the business asked its design consultant to check the light levels before signing off on the remodel drawings. The consultant checked and found that the existing light levels were about 75 foot-candles (units of measure), when 50 footcandles would have been plenty. So at no cost to the tenant, the designer changed the construction specifications to 3-lamp fixtures. There were 200 offices affected by this renovation, meaning that the firm saved more than $15,000 in 10 years by asking one simple question. That's a good deal.

Better Lighting Increases Sales and Productivity

New energy-efficient lighting can do more than just reduce your utility bills. It can also add value by:

- *Improving employee comfort and performance.* Energy-efficient lighting generates less localized heat than standard lighting, provides more pleasant color rendition, and helps prevent people from getting headaches by reducing the amount of flicker from the lights. Your employees will work better when their work environment is comfortable.
- *Improving sales.* Better color rendition means that your merchandise will look more appealing. Much like Muzak© in grocery stores, improved lighting will make customers feel more comfortable, and they will choose to stay longer in your store. This leads to more sales.
- *Improving your business' image as an environmentally responsible partner in your community.* Your customers will appreciate your efforts to lower pollution and protect the Earth for future generations.

Lighting Part II: Upgrades

What's your share of $17 billion? That's the amount EPA estimates commercial building owners and tenants could profitably save each year from lighting upgrades.

In this section we will help you identify lighting fixtures and controls in your own facility that can be replaced and add profits to your bottom line while keeping your investments a three-year simple payback or less. Many ideas pay for themselves in less than one year. Let's get started!

If you don't have time to read the whole section, just take a quick look at the next page. It's our *Thrifty Manager's High-Speed Do-It-Yourself Lighting Assessment*. Take a look at the action list, and call your lighting or electrical contractor if you have any of the fixtures noted. It's that easy.

The rest of this section expands on the ideas in the High-Speed Lighting Assessment and explores more comprehensive upgrades as well.

Remove Incandescent Lamps

Replace these lamps with *anything* else. Of the electricity consumed by an incandescent lamp, less than five percent is actually turned into useful light. Although incandescent lamps are appropriate for certain low-use areas such as closets, in most commercial applications incandescent lamps should be replaced.

Incandescent Lamp Replacement Options

Halogen	To highlight your product. Example of application: retail
Compact Fluorescent	To keep the same screw-in fixture. Example of application: hotel hallway
Tube Fluorescent	For general lighting.
Metal Halide	For white light in high-ceiling areas. Example of application: warehouse
High-Pressure Sodium	For use outside or where color doesn't matter. Example of application: outside security
LED	For exit signs.

Note: "Energy Saver" incandescent lamps aren't much more efficient than regular incandescent lamps. They save you money just by delivering less light. Usually this is not the best solution.

Replace incandescent lamps with halogen lamps. Halogen lamps are a type of incandescent lamp that is about twice as efficient as regular incandescent lamps. They last two to four times longer than most incandescent lamps, and they have become increasingly popular in spot lighting and other decorative applications. Halogen lamps are particularly popular in jewelry and upscale retail stores because they make gold and gems really sparkle.

The Thrifty Manager's High-Speed Do-It-Yourself Lighting Assessment

Do you have any of the following?

EXISTING LAMPS	USED AT LEAST
Incandescent lamps	6 hrs./day
Incandescent exit signs	24 hrs./day
Four or more fluorescent or incandescent fixtures on a single circuit	4 hrs./day more than needed
Incandescent or mercury vapor security lighting	10 hrs./day
Fluorescent lamps and ballasts more than eight years old	10 hrs./day

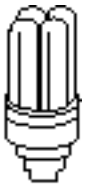
If you do, here are some of your savings opportunities.

OLD	NEW	SAVE ($/yr/lamp)	PAYBACK IN LESS THAN
Incandescent	Compact fluorescent	$12 energy + $3 O&M*	2 yrs.
Incandescent exit signs	LED exit signs	$22 energy + $11 O&M*	3 yrs.
Four or more fluorescent or incandescent fixtures on a single circuit	Occupancy sensor	$4 to $16 + $4 O&M*	3 yrs.
Incandescent or mercury vapor security lighting	Metal halide (white) or sodium (light yellow)	$40	4 yrs.
Fluorescent lamps and ballasts more than eight years old	T-8 lamp with electronic ballasts	$5	5 yrs.

* Operations and Maintenance

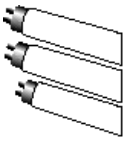
As an upgrade, the combination of better color, higher efficiency, and better cone reflectors means that many users can replace 150-watt floodlights with 35- or 60-watt halogen lamps and still get brighter, more focused light that has better color rendition. The most popular halogen lamps cost about $7 (compared with $1 for incandescent lamps), but they last four times as long as incandescent lamps and save about $25 in energy costs over their lifetime. They are a good deal even before you consider labor costs and the fact that they help move merchandise. The high operating temperatures of halogen bulbs can be a fire and personal safety hazard in some applications, so ask for advice when you first buy and install the lamps.

Halogen lamp retrofits typically pay for themselves in less than three years in energy savings alone if the fixtures are used at least two hours a day for screw-in retrofits or if used at least eight hours a day for fixture replacements.



Replace incandescent lamps with compact fluorescent lamps. Compact fluorescent lamps are fluorescent lamps that have been specifically made in a compact form to replace incandescent lamps in traditional screw-in fixtures. Compact fluorescent technology has improved recently, and the lamps currently available in the marketplace are brighter and have very good color rendition properties. For example, most modern hotels have installed compact fluorescent lamps for corridor lighting. The fixture pictured on this page contains a compact fluorescent lamp and costs less than $40. Compact fluorescent fixtures with reflectors provide an excellent substitute for floodlamps.

The table below shows the equivalency of compact fluorescent lamps to incandescent lamps. You can replace these yourself—most major hardware stores stock compact fluorescent lamps that screw right in place of incandescent lamps and cost as little as $5 on the Internet. Utility rebates can reduce your cost even further.



Replace incandescent lamps with tubular fluorescent lamps. Fluorescent lamps are the common tube lamps found in almost every small business. They are usually about three to four times more efficient than incandescent lamps and can last 8 to 20 times longer. With newer fluorescent lamps, you can also specify color correction to avoid the pasty image traditionally associated with fluorescent lamps.

Tubular fluorescent lamps have much lower maintenance costs than incandescent or compact fluorescent lamps.

Would you believe this attractive fixture is made specifically for compact fluorescent lamps and costs less than $40?

If You Have Incandescent Lamps	Replace Them With These Compact Fluorescent Lamps
25 watts	5 watts
40 watts	7 watts
60 watts	13 watts
75 watts	22 watts
100 watts	27 watts

Comparing Incandescent Lamps and Fluorescent Lamps

Lamp Type	Energy Costs	First Cost	Life	Color	Maintenance Costs
Incandescent	Much Higher	Lower	Shorter	Good	Higher
Fluorescent	Much Lower	Higher	Longer	Better to Worse	Lower

Replace your incandescent lamps with just about any variety of fluorescent lamp and your lighting, energy, operating, and maintenance costs may decrease by about 75 percent.

Replace incandescent exit signs with light-emitting diode (LED) exit signs. LED exit signs use light-emitting diodes that provide exit lighting and are commonly seen in electronic devices such as clock radios.

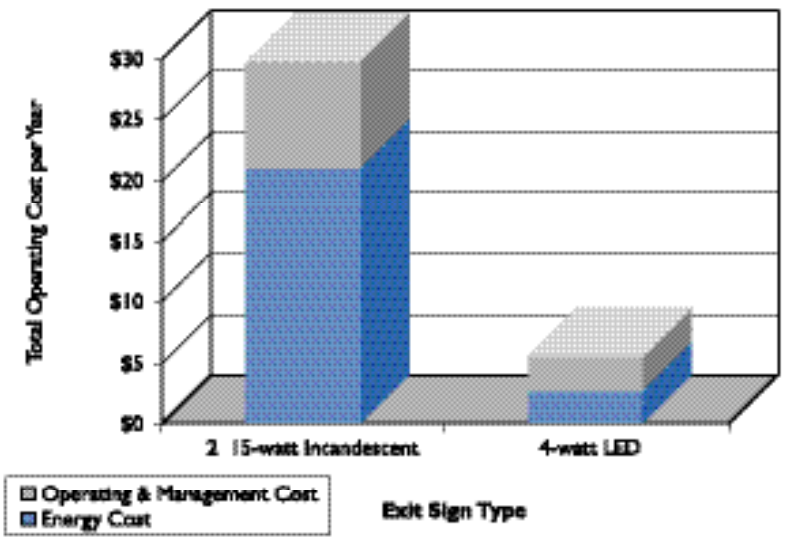
You can buy an upgrade kit to convert existing exit signs for $15 to $75 and do it yourself, or you can purchase new fixtures and install them for less than $100. Because the upgrade kits don't require any wiring, they are easier to install yourself than new signs if there is room inside the panel to install them. LED exit signs use about five percent of the energy used by incandescent exit signs and 20 percent of the energy used by compact fluorescent exit signs. LED exit signs also last 10 to 20 times longer.

The most efficient LED exit signs on the market today are part of the EPA ENERGY STAR LED program. ENERGY STAR -labeled exit signs save on maintenance costs because of their long life. An ENERGY STAR-labeled LED exit sign can last 25 years without a lamp replacement, compared to less than one year for an incandescent. Look for the ENERGY STAR label when purchasing your new exit sign.

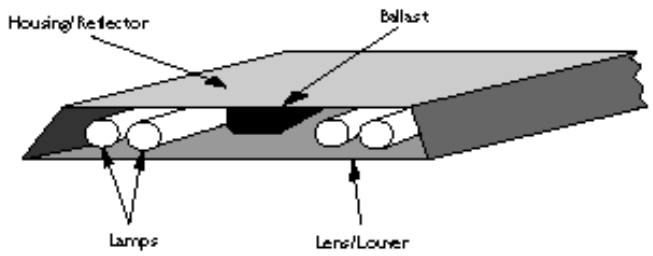
Given their installation costs, their lower maintenance costs, and low energy costs, they generally pay for themselves in one to three years. For more information on ENERGY STAR manufacturers you can visit our Web site at www.epa.gov/energystar.

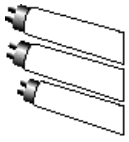
See the bar chart on this page for annual operating costs for exit signs.

Annual Operating Cost Per Exit Sign



Tech Talk: Components of a Light Fixture

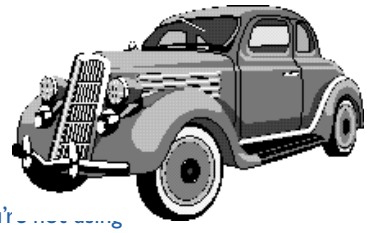




Upgrade Fluorescent Lamps

Even within the generally efficient category of fluorescent lighting, you can reduce your energy use by more than 66 percent by changing from the worst to the best type of fluorescent tubes. Fluorescent lamps were introduced at the World's Fair in New York City and San Francisco in 1939. Surprisingly, their designs changed little over the years until recent breakthroughs that have significantly improved their efficiency and the quality of the light they produce.

T-8 lamps and electronic ballasts. T-8 lamps use their smaller diameters, phosphors, and coating to improve efficiency by about 10 percent compared with standard T-12 lamps. Electronic ballasts use about 30 percent less energy than old magnetic ballasts. Ballasts are devices that provide the proper voltage and current to fluorescent lamps, which don't regulate themselves like incandescent lamps. T-8 conversions cost $50 to $100 per fixture, so you might wonder if it is worth the trouble. The answer depends on your local electricity costs and how often you use the lights. Generally if you use the lamps 60 hours per week or more the answer is "yes" or at least "yes, it's worth finding out more information." All you need to do is ask your local lighting contractor or electric utility company to perform a detailed analysis for you. This can usually be done free of charge.



If you're [illegible] T-8 lamps and electronic ballasts in your fluorescent fixtures, you're using vintage 1940s lighting technology.

Other ideas. T-8 lamps and electronic ballasts aren't your only solution. Modest gains are achieved from 34-watt "energy saver" lamps. De-lamping and/or reflectors can help also, as discussed later in this section. Some designers are switching from fluorescent tubes to lower power metal halide fixtures for a more industrial look. Consider the example scenario shown at the bottom of this page. There are four different retrofit options. None is the single "right" answer. They are all

Explore Your Options

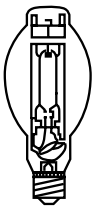
A business has 20 4-lamp, 4-ft. fluorescent fixtures in an office area. They are on about 50 hours a week. The primary tasks of most occupants require computer use. Recommended light level is between 50 and 75 footcandles.

Current Light Level	95 footcandles
Current Energy Use	9,984 kWh/year
Current Annual Energy Costs (at $0.08/kWh)	$799

Upgrade options	Energy savings kWh/year	Cost $	Annual savings $	Simple payback years	Light level	Light quality
Option 1: Install 34-watt "energy saver" lamps. Light level is lowered to about 85 footcandles.	1,664	$360	$133	2.7	Improved	Slightly better
Option 2: Install four T-8 lamps and an electronic ballast in each fixture. Light level remains the same.	3,744	$1,280	$300	4.3	Still too high	Much better
Option 3: Install two T-8 lamps in each fixture, with a specular reflector. Fixtures are "tandem-wired" so two fixtures share a single ballast. Light level becomes 55 footcandles.	6,916	$1,340	$553	2.4	Ideal	Much better
Option 4: Install new deep-cell parabolic fixtures with T-8 lamps and electronic ballasts. Fixtures are "tandem-wired" and light level becomes 55 footcandles.	6,916	$2,600	$553	4.7	Ideal	Ideal

If you replace your outside security incandescent lamps with sodium lamps, your exterior lighting costs may decrease by 80 to 90 percent.

viable, cost-savings, quality-enhancing ideas. Choosing between them is a business and design decision.



Install High-Intensity Lamps

If you work in a warehouse with high ceilings and don't have fluorescent lamps, you probably use high-intensity discharge (HID) lamps. Mercury vapor lamps use older technology and are less efficient than other HID lamps, although they do provide a white light.

Upgrade from mercury vapor. At a bare minimum, you should replace mercury vapor lamps with more efficient metal halide lamps as the old lamps burn out. Even if you need to replace the ballast or the whole fixture, it turns out to be economical for almost everyone and no one can even tell you're doing it. Metal halide lamps render colors as well as mercury vapor lamps. They come in a variety of power outputs from 50 to 2,000 watts and have long life. They also come with a clear or coated bulb. The coated bulb has the best color rendition property and can be used for display lighting.

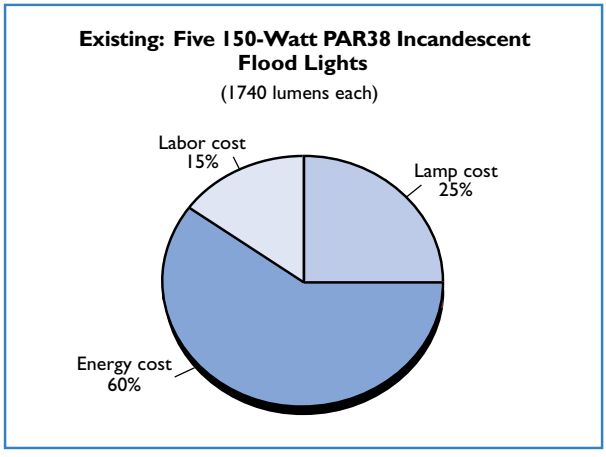
Use metal halide for retail. You've probably seen metal halide lights without even realizing it. Most of the new "big box retail" stores are illuminated using metal halides. They are the bright white lights typically hung from the ceiling girders at 20 to 30 feet. If you have high bay retail, switch from fluorescent to metal halide for a brighter look without increasing your energy costs. Typical payback: five years, less if it increases sales.

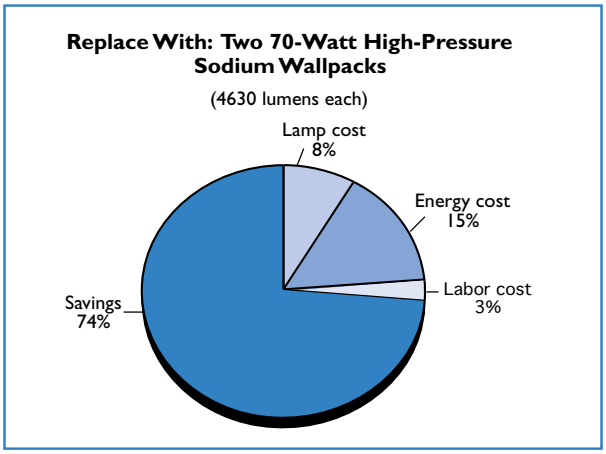
Also, manufacturers have recently started selling small metal halide spotlights. The bright white light combined with the narrow beam and sparkle can make merchandise really stand out—the benefits of halogen with lower energy costs!

Use metal halide or high-pressure sodium in warehouses. Choose high-pressure sodium where light quality is not critical and rock-bottom energy use is the goal. Typical payback based on 12-hour-per-day warehouse use is about three years.

Use metal halide instead in high-profile or color-sensitive areas or areas where people need to perform detailed work.

Install high-pressure sodium lamps outside. High-pressure sodium lamps are popular for warehouse, outdoor, street, and security lighting. They come in a variety of power outputs from 35 to





1,000 watts and have about a 20,000-hour life. Sodium lamps are the most efficient lamps you can buy. Most of them have a light yellow tint, but some of the newer lamps have an attractive white color rendition and can even be used for display purposes. These new lamps tend to fade from white after a certain number of hours of use, so be sure to discuss the issue with your contractor prior to installation in customer service areas.

Carefully consider low-pressure sodium lamps. They are efficient but *very* yellow and usually not recommended, except for loading docks and some security uses. Replace your outside security incandescent lamps with sodium lamps and your costs may decrease by between 80 and 90 percent. The typical payback time is less than two years.

Remove Lamps

What could be a better deal than getting savings with no up-front cost? In many offices 2 lamps in a 4-lamp fluorescent fixture may be removed while still meeting recommended lighting levels. People working on computers will probably prefer the lower level because it increases the contrast on their monitors. You can experiment to see if removing lamps makes sense in your facility. Corridors are also good places to start because these areas often are overlit. Cost: $0. Simple payback time: 0.0 years.

Lowering the number of lamps can also be an excellent measure when combined with installation of reflectors. Reflectors are not for everyone. We've found reflectors are best applied to areas that start with about 50 percent too much light and 4-lamp fluorescent fixtures. If that sounds like your site, remove half of the lamps and add reflectors to meet your target amount of light. Ask a lighting professional if they would be applicable in your facility.

Controls To Turn Lights Off

One easy way to save money and help your lights last longer is to turn them off when they are not needed. Occupancy sensors detect people in a room using ultrasonic or infrared sensors. These sensors cost between $25 and $80 and are an excellent choice for bathrooms or conference rooms that are likely to be unoccupied for large portions of the day. Photocells are designed to turn exterior lights on automatically when it gets dark. Motion sensors are suited to exterior security lighting, loading dock areas, and doorways. These sensors turn lights on automatically when a person is detected.

Automatic dimming systems that adjust lamp output based on measured sunlight also are starting to find application.

Energy-Savings Potential With Occupancy Sensors

Application	Energy Savings
Offices (private)	25–50%
Offices (open spaces)	20–25%
Rest rooms	30–75%
Corridors	30–40%
Storage areas	45–65%
Meeting rooms	45–65%
Conference rooms	45–65%
Warehouses	50–75%

Note: Figures listed represent maximum energy-savings potential under optimum circumstances. Figures are based on manufacturer estimates. Actual savings may vary.

Source: California Energy Commission/U.S. Department of Energy/ Electric Power Research Institute

Other Lighting Technologies

Your lighting needs may be suited to other technologies involving advanced controls or alternative lighting equipment. Many fixtures can simply have some of the lamps removed with installation of reflectors. You may have exterior lighting suited to installation of low-pressure sodium fixtures, which are efficient types of lighting used when lighting quality is not important at all. You can find out about these and other technologies by calling the toll-free ENERGY STAR hotline at 1-888-STAR YES.

Take the First Step Toward Implementation

The following steps will help you decide whether you should proceed further with the lighting upgrade project.

1. Do the simple lighting assessment on page 40; or investigate and analyze other opportunities.

   Then, calculate simple payback for the project. (Refer to the box below.)

2. Call your local contractor if your simple payback is five years or less.

Remember, you won't save a dime until the new hardware is installed. Every day you wait, you lose money that can never be recovered.

Where Can I Learn More?

Call toll-free 1-888 STAR YES and ask for "small business tech support" or visit lighting products at www.energystar.gov/products.

How To Calculate Simple Payback

The Short Version

Simple Payback = Measure cost x 1000 ÷ [(watts before - watts after) x hours/year x energy cost]

Example:

Payback = $400 measure cost x 1000 ÷ [(500w before - 100w after) x 6000 hrs/yr use x $0.08/kWh] = 2.1 years

Success Stories

Energy for the Kids at Sligo Adventist School

When Kenneth Gair, Plant Manager for the Sligo Adventist School, talks about his involvement with EPA's ENERGY STAR program, his face lights up. He has good reasons to smile—his facility received an ENERGY STAR Partner of the Year award in 1995 for the work done to upgrade the lighting system in the school. Maybe his best reason to smile is that all the wasted energy that went into inefficient lighting systems now helps to power the school's new computer lab!

The lighting system at Sligo was more than 30 years old and very inefficient. Gair decided to upgrade the system by starting with the areas that would give him the quickest payback. He started with the hallways by replacing incandescent lamps with T-8 lamps and electronic ballasts. This upgrade improved light levels and certainly caught everyone's attention. People were very happy with their new working environment. He then moved on to the cafeteria and the gym. Both areas were lit with 300-watt incandescent lamps, which he replaced with metal halides. In the gym, for example, he replaced 36 300-watt incandescent lamps with 10 400-watt metal halides. Mr. Gair also upgraded outside lighting to high-pressure sodium fixtures.

Classroom lighting was upgraded to T-8 lamps, and electronic ballasts and sensors were added to each room. The hardest part about installing the sensors, Gair says, was fine-tuning the sensitivity and the delay time of the sensor. At first he got a few complaints from teachers and students because the lights would typically go off in the afternoon when teachers were alone in their rooms. Gair was able to establish the right delay time to have the classrooms lit when needed and to ensure that the lights would only be off when they were supposed to be off.

Technical information for carrying out the program came mostly from the ENERGY STAR program. Gair received a video explaining the significance of sensors and how to choose the right one for his application. He used passive infrared sensors in the classrooms and ultrasonic sensors for the restrooms.

Gair used several innovative ways to fund his upgrades. He gained the support of the school's Parent Teacher Council and used the money he received to finance his first project. Then he applied for rebates at his local utility. The money from the rebate was then funneled back to the next project, and so on. Gair was able to do most of the work himself. He managed to get extra labor at an affordable price by hiring high school students from the neighboring school.

Now that Gair has completed the lighting stage of the program (Stage One), he is looking into window replacement (Stage Three) and heating and cooling system upgrades (Stages Four and Five). Although these will be more expensive upgrades, the success of his early project will help Gair show that energy efficiency really does pay.

When we asked about his next project, he happily marched us to the schoolyard to show us an all-recycled playground!

Building Tune-Up

All cars should get tune-ups or an oil change every few thousand miles to keep them running smoothly and to help them last longer. When was the last time you gave your building and equipment a tune-up? You'll get the same kind of savings with a building tune-up as you would with an automobile tune-up—modest savings at a low cost—and an opportunity to extend the life of your investment. Every once in a while you can even get a boost in horsepower.

Check your timers and thermostats. Did you adjust them for daylight saving time? What about the last time there was a power outage? Did your weekly calendar compensate for last February 29? Does the temperature seem right? Most mechanical timers won't correct for power outages. Resetting them will improve comfort and save you some money. Ask your heating contractor to recalibrate your thermostat the next time they visit.

Check your filters. Unless the filters are inaccessible, you don't need to call your heating and cooling contractor out for an expensive visit just to make sure you have clean filters. Check the filters every month or two. Each dirty $2 filter you replace will make your air cleaner, work your fan less, and keep the inside of the system cleaner so that it operates more efficiently. Although a new filter might only cost $2, each dirty filter can cost you $5 a month in extra energy consumption and can decrease the life of your system.

Check your bills. Do you know how much your electric bill is now compared to a year earlier? Once or twice a year, take time to look at and compare your bills. Perhaps compare them with your next door neighbor's bills as well.

A low cost tune-up of your building and equipment will save money on energy costs, extend the life of your investment and keep your tenants happy.

Success Stories

Something To Dance About

During a periodic review, a dance studio manager in New York City noticed that his total electric bill had gradually increased to the point of doubling over the course of a year. He was now paying about $500 per month instead of the $250 he used to pay. His business hadn't changed and the rates looked about the same, so he called the local utility for help. The utility company sent out an energy auditor who performed a free assessment. The auditor concluded that wiring inadvertently allowed the expanding business next door to use the studio's power. That 5-minute comparison and free assessment saved the studio $200 per month!